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ABSTRACT

This biology course is especially recommended for students interested in a vocation in nursing, medical technology, dental hygiene or other para-medical areas. In part, it is considered a second course in biology. The course includes an intensive in-depth study of the respiratory structures, nerve and chemical control of breathing, gas exchange, and common respiratory disorders. Emphasis is likewise placed on the composition of blood, the structures of the heart, its physiological activities, and related disorders of the circulatory system. Kimber's "Anatomy and Physiology" and Morrison's "Human Physiology" are the listed state-adopted texts. The course outline presents 8 relevant topics to lead the student in accomplishing 20 suggested performance objectives. Eighty-six experiments and/or demonstrations are listed with pertinent references given. Activities, including projects, reports, field trips and speakers are included in the course description. Several audio-visual aids are recommended and an extensive reference list is included. A master sheet presents the well-coordinated use of all suggested learning activities. (Author/EB)

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U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

RESPIRATORY AND CIRCULATORY SYSTEMS

5363.04

5346.04

(Experimental)

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1971

SE017 125

ED 086525

RESPIRATORY AND CIRCULATORY SYSTEMS

5363.04

5346.04

SCIENCE

(Experimental)

Written by
Alan Weiss, Richard Petty
and Peter Saponaro
for the
DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida
1972

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RESPIRATORY AND CIRCULATORY SYSTEMS

COURSE DESCRIPTION

This course will include an intensive in-depth study of the respiratory structures, nerve and chemical control of breathing, gas exchange, and the common respiratory disorders. In addition, heavy emphasis will be placed on the composition of blood, the structures of the heart, its physiological activities, and related disorders of the circulatory system.

ENROLLMENT GUIDELINES

This course is for the interested student in biology. It is especially recommended for students interested in a vocation in nursing, medical technology, dental hygiene or other para-medical areas. It should follow credit or background in previous biology programs and is, in part, a second course in biology.

STATE ADOPTED TEXTS

1. Kimber, et al. Anatomy and Physiology. 15th ed. New York: The Macmillan Company, 1966.

2. Morrison, Cornett, Tether, Gratz. Human Physiology. New York: Holt, Rinehart, and Winston, Inc., 1967.

PERFORMANCE OBJECTIVES

1. On a practical examination of a cat, identify the major structures of the nasal cavity, pharynx, larynx, trachea, bronchi, thoracic cavity and lungs.

2. Analyze the actions of the diaphragm and the intercostal muscles in breathing.

PERFORMANCE OBJECTIVES (Continued)

3. Identify the factors that control the rate of respiration.

4. Given a graph of a "normal" pulmonary function test on a spirometer, analyze the following: residual capacity, inspiratory capacity, vital capacity, residual volume, expiratory reserve volume, inspiratory reserve volume, and tidal volume.

5. Analyze the chemical activities associated with the movement of oxygen and carbon dioxide between the lungs and the blood, and the blood and the tissues.

6. Describe the various disorders associated with the respiratory system, such as asthma, bronchitis, pneumonia, dry and effusion pleurisy, emphysema, lung cancer and hypoxia.

7. Differentiate between the plasma and formed elements of the blood including their functions.

8. On a practical examination of the cat, identify all the major blood vessels in the body and the major parts of the heart.

9. Integrate the function of hematopoietic tissue with regard to regulations of the number and type of formed elements in the blood.

10. Investigate the following disorders of the blood: Anemias, leukocytosis, mononucleosis, agranulocytosis, hemophilia, thrombophlebitis, thrombocytopenic purpura.

11. Analyze the immune mechanism with regard to the following: antigen and antibody, paccipitation, agglutination, complement fixation.

12. Discriminate among humoral immunity, tissue immunity, active immunity, passive immunity, vaccination, and allergy.

13. Illustrate the mechanism of blood coagulation.

14. Discuss critically blood homeostasis in terms of chemical composition, pH, and pressure changes.

15. Identify on a practical examination of a cow heart <u>all</u> the major anatomical structures.

16. Integrate events of an EKG with the mechanical and physiological events of the heart with emphasis on the cardiac cycle and its controlling factors.

PERFORMANCE OBJECTIVES (Continued)

17. Relate the major heart and circulatory disorders, for example, thrombosis, arteriosclerosis, atherosclerosis, occlusion to the coronary and cerebral circulation.

18. Identify the variables affecting changes in blood pressure.

19. Distinguish among blood plasma, interstitial fluid, and lymph.

20. List the functions of the lymphatic system.

COURSE OUTLINE

I. Respiratory Structures

   A. Nose, pharynx, larynx, trachea, lungs

   B. Mechanics of breathing

II. Breathing

   A. Gas laws and the atmosphere

   B. Lung capacity

   C. Nervous and chemical control of breathing

   D. Breathing disorders

III. Gas Exchange and Phonation

   A. Transportation of oxygen and carbon dioxide

   B. Respiratory failure and artificial respiration

   C. Organs of phonation and sound production

IV. Internal Transport

   A. Body fluids

   B. Composition and functions of blood

      1. Plasma

      2. Blood cells

   C. Circulation

COURSE OUTLINE (Continued)

V. Blood Solids

A. Marrow and cell formation

B. Erythrocytes, leucocytes and platelets

C. Regulation of blood cell numbers

D. Blood disorders

VI. Blood Plasma

A. Plasma proteins

B. Clotting

C. Immunity - antibody production

D. Physiological shock

E. Acid-base equilibrium

F. Hemorrhage

G. Blood typing

VII. The Heart

A. Structure and cardiac cycle

B. Heartbeat rate and its control

C. Electrocardiograms and heart sounds

VIII. Circulation of Body Fluids

A. Blood circulation

B. Blood pressure

C. Measurement of blood pressure

1. Influence of cerebral cortex

2. Carbon dioxide influence

3. Influence of drugs

COURSE OUTLINE (Continued)

E. The spleen

F. Lymphatic system

EXPERIMENTS AND/OR DEMONSTRATIONS

Chaffee, Ellen. Laboratory Manual in Physiology and Anatomy. Philadelphia: Lippincott, 1969.

1. Introduction to the Circulatory System (Exp. 14, p. 123)
2. The Heart (Exp. 15, p. 131)
3. Major Veins of the Body (Exp. 17A, p. 149)
4. Major Arteries of the Body (Exp. 16, p. 141)
5. The Lymphatic System (Exp. 17B, p. 157)
6. The Physiology of Circulation (Exp. 18, p. 163)
7. The Respiratory System (Exp. 19, p. 171)

Anthony, Catherine Parker. Anatomy and Physiology Laboratory Manual. St. Louis: C. V. Mosby Company, 1967.

8. The Blood (Exp. A, B, C, p. 153)
9. The Heart (Exp. A, p. 155)
10. Arteries of the Body (Exp. B, p. 159)
11. Veins of the Body (Exp. C, p. 163)
12. Lymph Drainage of the Body (Exp. D, p. 167)
13. Physiology of Circulation (Exp. A, B, C, p. 169)
14. Anatomy of the Respiratory System (Exp. A, B, C, p. 175)
15. Physiology of the Respiratory System (Exp. A, B, p. 185)

Leavell, Lutie; Chapin, Florence; and Miller, Marjorie. Workbook and Laboratory Manual in Anatomy and Physiology. New York: Macmillan Company, 1964.

16. Examination of Blood Cells (Exp. A, p. 112)
17. Hypertonic, Hypotonic and Isotonic Effects on Erthrocytes (Exp. B, p. 115)
18. Hemoglobin Determination (Exp. C, p. 117)
19. Coagulation Time of Blood (Exp. D, p. 118)
20. Blood Grouping and Typing (Exp. E, p. 121)
21. Rh Factor (Exp. F, p. 122)
22. Structural and Physiologic Relationships of the Heart and Lungs (Exp. A, p. 123)

EXPERIMENTS AND/OR DEMONSTRATIONS (Continued)

23. Respiration (Exp. B, p. 129)
24. Respiratory Sounds (Ex. C, p. 131)
25. Respiratory Volume (Exp. D, p. 134)
26. General Circulation (Exp. E, p. 136)
27. Blood Pressure (Exp. F, p. 139)
28. The Lymphatics (Exp. G, p. 142)
29. The Hematocrit and Hemoglobin Concentration (Exp. 13, 14, p. 47)
30. Specific Gravity of Blood (Exp. 15, p. 50)
31. Coagulation of Blood (Exp. 16, p. 52)
32. Erthrocytes -- Fragility, Hemolysis, Agglutination and Crenation (Exp. 17, 18, p. 56)
33. Blood Typing and Rh Factor (Exp. 19, 20, p. 60)
34. Blood Volume (Exp. 21, p. 65)
35. Anatomy of the Mammalian Heart (Exp. 22, p. 68)
36. Propagation of Heart Impulse (Exp. 23, p. 73)
37. Factors Influencing the Heart (Exp. 24, p. 75)
38. Ion Balance and Activity of the Heart (Exp. 25, p. 78)
39. Circulation (Exp. 26, p. 81)
40. Pulse Rate and Blood Pressure in Man (Exp. 27, 28, p. 84)
41. Cold Pressor Test and Vascular Responses (Exp. 29, 30, p. 90)
42. Factors Influencing Blood Pressure (Exp. 31, p. 95)
43. Respiratory Mechanics and Movements (Exp. 32, 33, p. 102)
44. Respiratory Volumes (Exp. 34, p. 107)
45. Artificial Respiration (Exp. 35, p. 110)
46. Carbon Dioxide Content of Alveolar Air (Exp. 36, p. 111)
47. Factors Influencing Respiration (Exp. 37, p. 114)

Jones, Claiborne and Lehman, Lillian. Laboratory Guide in Introductory Vertebrate Zoology. Chapel Hill: Department of Zoology, University of North Carolina, 1969.

48. Circulatory System of the Dogfish Shark (Exp. III, p. 42)
49. Respiratory System of the Frog (Exp. III, p. 47)
50. Circulatory System of the Frog (Exp. III, p. 48)

Elliott, A. M. Laboratory Guide for Zoology. Minneapolis: Burgess Publishing Company, 1957.

51. Circulatory System of the Frog (Exp. IV, p. 155)
52. Breathing System of the Frog (Exp. IV, p. 159)
53. Circulatory System of the Fetal Pig (Exp. V, p. 200)
54. Breathing Systems of the Fetal Pig (Exp. V, p. 205)

EXPERIMENTS AND/OR DEMONSTRATIONS (Continued)

Biological Sciences Curriculum Study. Biological Science: Molecules to Man. Boston: Houghton Mifflin Company, 1963.

55. Capillary Circulation (Exp. 42, p. L87)
56. Properties of Human Blood (Exp. 43, p. L89)
57. Exploring a Mammalian Heart (Exp. 44, p. L92)
58. Effects of Variables on the Heartbeat Rate of Daphnia (Exp. 45, p. L93)
59. Measuring Carbon Dioxide Production in Animals (Exp. 47, p. L96)

Booth, Ernest S. and Chiasson, Robert B. Laboratory Anatomy of the Cat. Dubuque: Wm. C. Brown Company, 1970.

60. The Circulatory System of the Cat (Chapt. 6, p. 38)
61. The Respiratory System of the Cat (Chapt. 5, p. 36)

Morrison, Thomas F.; Cornett, Frederick D.; Tether, J. Edward.; and Bratz, Pauline. Experiments in Physiology. New York: Holt, Rinehart and Winston Inc., 1967.

62. Changes in Air During Respiration (Exp. 54, p. 40)
63. The Gross Anatomy of the Respiratory System (Exp. 55, p. 41).
64. Mechanics of Breathing (Exp. 56, p. 41)
65. The Effect of Pulmonary Ventilation on Respiratory Rate (Exp. 57, p. 42)
66. The Capacity of the Lungs (Exp. 58, p. 43)
67. Regulation of Breathing (Exp. 59, p. 44)
68. The Structure of Blood Cells (Exp. 60, p. 45)
69. The Hemoglobin Content of the Blood (Exp. 61, p. 46)
70. The Identification of Hemin Crystals (Exp. 62, p. 47)
71. The Formation of Fibrin (Exp. 63, p. 47)
72. Blood Typing (Exp. 64, p. 48)
73. The Pulse Rate (Exp. 65, p. 49)
74. Heart Sounds (Exp. 66, p. 50)
75. Pressure Points (Exp. 66, p. 50)
76. Surface Veins (Exp. 68, p. 52)
77. Arterial Blood Pressure by the Palpatory Method (Exp. 69, p. 53)
78. Arterial Blood Pressure by the Auscultatory Method (Exp. 70, p. 54)
79. Venous Blood Pressure (Exp. 71, p. 54)
80. The Effect of Exercise and Postural Changes on Blood Pressure, Heart Rate, and Venous Pressure (Exp. 72, p. 55)

Phipps and Bird Inc. A Physiology Manual for the Biology Teacher. Richmond: Phipps and Bird, Inc., 1967.

81. Respiratory Patterns (Exp. 1, p. 5)
82. Effect of Exercise on Respiration (Exp. 2, p. 7)
83. Sensory Stimuli Affecting Respiratory Movements (Exp. 3, p. 9)
84. Breath Holding Times (Exp. 4, p. 11)
85. Role of Carbon Dioxide in Controlling Respiratory Rate (Exp. 5, p. 13)
86. Vital Capacity (Exp. 6, p. 15)

PROJECTS

1. Construct an apparatus that will illustrate the diaphragm's action on the lungs.
2. Devise and conduct an experiment to calculate rate of erthrocyte production in rats.
3. Construct a spirometer.
4. Construct an electrical pulse monitor.

REPORTS

1. Selected reports on Diseases and/or Disorders of the Circulatory System.
2. Selected reports on Diseases and/or Disorders of the Respiratory System.

FIELD TRIPS

1. Hematology Laboratory of Local Clinic or Hospital.
2. Blood Bank.
3. Observe the inhalation therapy equipment at a local hospital.

SPEAKERS

1. American Cancer Society
2. Heart Association of Greater Miami
3. Inhalation Therapist
4. Hematologist

FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER

1. Nose: Structure and Function
   1-03112, 11', B/W
2. Healthy Lungs
   1-03058, 11', C
3. Mechanisms of Breathing
   1-03109, 11', B/W
4. Respiration (A.I.B.S. Pt. 4, No. 4)
   1-30434, 28', C
5. Your Voice
   1-04291, 10', B/W
6. Circulation (A.I.B.S. Pt. 4, No. 2)
   1-30424, 28', C
7. Story of the Blood Stream, Pt. 1
   Heart and Circulatory System
   1-30714, 29', C
8. Story of the Blood Stream,Pt. 2
   The Red Blood Cell
   1-30715, 27', C
9. Hemo the Magnificent, Pt. 1
   1-40027, 35', C
10. Hemo the Magnificent, Pt. 2
    1-40032, 35', C
11. The Heart and Circulation
    1-03093, 10', B/W

FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER (Continued)

12. Heart Disease -- It's Major Causes
I-03421, 11', B/W

13. The Human Body -- Circulatory System
I-11226, 14', C

14. Body Defenses Against Disease
I-03062, 11', B/W

15. Circulation
I-12977, 16', C

16. Circulation of the Blood
I-03102, 9', C

17. Common Heart Disorders and Their Causes
I-11365, 17', B/W

18. Heart: How It Works
I-03097, 12', B/W

19. Phagocytes: The Body's Defenders
I-03103, 10', C

20. Smoking and Lung Cancer
I-30722, 28', B/W

21. Work of the Blood
I-11231, 13', C

FILM LOOPS

Norris Physiology Series - Ward's Natural Science Establishment

1. Frog Heartbeat - I
73W 1721, $18.50.

2. Frog Heartbeat - II
73W 1722, $18.50

3. Turtle Heart Neural Control
73W 1725, $18.50

4. Turtle Heart Neural Control
73W 1726, $18.50

FILM LOOPS (Continued)

Encyclopedia Brittanica Educational Company

5. Heart in Action
   80052

6. Circulation, The Flow of Blood
   80053

7. Breathing Movements
   80054

8. Blood Smear Preparation
   80055

9. Blood Typing
   80644

Ealing

10. Histological Techniques: Counting Cells
    81-0812/1

SLIDES, 2" x 2"

Ward's Natural Science Establishment, Inc.

1. The Cardiovascular System
   170W 8000, 25 slides.

2. The Respiratory System
   170W 8050, 22 slides.

3. The Hematopoietic System
   82 W 8200, 21 slides.

FILM STRIPS

Eye Gate House, Inc.

1. Respiratory Systems
   2-1-E

2. Circulatory Systems
   2-1-C

FILM STRIPS (Continued)

Film of the Month

3. Smoking and Health
   1541

Popular Science Audio-Visuals

4. Blood Cell Physiology
   1566

5. Blood Types
   1560

TRANSPARENCIES AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER

1. Anatomy: Circulatory System
   2-30034

2. Circulatory System - Heart Pumping Cycle
   2-00207

3. Circulatory System - Man No. 1
   2-00062

4. Circulatory System - Man No. 2
   2-00070

5. Human Circulatory System
   2-00029

6. Human Mouth and Nasal Cavities
   2-00035

7. Respiratory System
   2-00155

8. Respiratory System - Man
   2-00061

9. Structure of the Human Heart
   2-00171

10. Structure of the Human Heart
    2-00046

REFERENCES

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2. Carlson, Anton; Johnson, Victor; Cavert, H. Mead. Machinery of the Body. Chicago, Illinois: University of Chicago Press, 1961.

3. Chaffee, Ellen and Greisheimer, Esther. Basic Physiology and Anatomy. Philadelphia: J. B. Lippincott Company, 1969.

4. Crouch, James. Functional Human Anatomy. Philadelphia: Lea and Febiger, 1970.

5. DeRobertis, E. D. P.; Nowinski, Wiktor W.; and Saez, Francisco A. Cell Biology. Philadelphia: W. B. Saunders, 1968.

6. Frohse, Franz; Brodel, Max; and Schlossberg, Leon. Atlas of Human Anatomy. New York: Barnes and Noble, 1961.

7. Ganong, William F. Review of Medical Physiology. Los Altos, California: Lange Medical Publications, 1965.

8. Guyton, Arthur. Function of the Human Body. Philadelphia: W. B. Saunders Company, 1969.

9. Jacob, Stanley and Francone, Clarice. Structure and Function in Man. Philadelphia: W. B. Saunders Company, 1965.

10. Torrey, Theodore W. Morphogenesis of the Vertebrates. New York: John Wiley and Sons Company, 1967.

Objectives	Text	Laboratory Experiments and/or Demonstrations	Films	Film Loops	Film Strips	Transparencies	2" x 2" Slides	Supplementary References
1	#2. pp. 256-265	7,61						#1. pp. 16-17 #3. pp. 416-418 #5. pp. 105-128 #6. pp. 82-98 #8. pp. 160-161
2	#2. pp. 266-275	7,16,41,54,61, 63,83	2,3,4	7	1	6,7,8		#2. pp. 257-262 #3. pp. 478-485 #4. pp. 405-428 #6. pp. 82-88 #7. pp. 508-514 #8. pp. 223-224 #9. pp. 163-164
3	#2. pp. 277-284	15,22,46,57, 59,62,64,67, 82,84,85	2,3,4		1			#2. pp. 269-279 #3. pp. 444-449 #4. pp. 405-428 #7. pp. 525-532 #8. pp. 211-213 #9. pp. 165-167
4	#2. pp. 266-269	25,44,65,81, 84,86						#2. pp. 282-286 #3. pp. 438-444 #7. pp. 513-515 #8. pp. 276-278 #9. pp. 163-164
5	#2. pp. 277-279	6,13,46,62			1			#2. pp. 291-302 #3. pp. 441-444 #7. pp. 518-524 #8. pp. 233-235 #9. pp. 165-167
6		25	2,19					#2. pp. 305-309 #3. pp. 435-441 #5. pp. 105-128 #7. pp. 515-517 #8. pp. 236-244 #9. pp. 168-173
7	#2. pp. 290-293, 298-307	1,8,14,30, 34,36,68, 69	6,8,9,10, 18,20	6,8,10	2,4,5			#2. pp. 51-113,135-136 #3. pp. 296-304 #5. pp. 85-87 #7. pp. 488-521 #8. pp. 85-90 #9. pp. 280-282 #10. p. 103
8		2,3,4,5,9, 10,11,12,28, 28,35,43,50, 51,53,57,69				1,3,4,5	1	#2. pp. 321-330 #3. pp. 293-335 #9. pp. 231-240 #1. pp. 38-46
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MASTER SHEET--RESPIRATION AND CIRCULATION SYSTEMS (Continued)

Objectives	Text	Laboratory Experiments and/or Demonstrations	Films	Film Loops	Film Strips	Transparencies	2" x 2" Slides	Supplementary References
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13	#2. pp. 309-312	1,9,31,70			2,4			#2. pp. 79-91 #3. pp. 307-312 #5. pp. 103-105 #7. pp. 417-420 #8. pp. 107-111 #9. pp. 289-291
14	#2. pp. 313-315	17,27,29,30, 32,40,41,42, 77,78,79,80	6,8,9,10, 13,14,15,20		2,4			#2. pp. 68-134 #3. pp. 296-320 #7. pp. 408-421 #8. pp. 111-116 #9. p. 289
15	#2. pp. 322-328	2,9,35,57	11,12,17			2,9,10	1	#2. pp. 137-147 #3. pp. 296-320 #4. pp. 293-309 #8. pp. 119-131 #9. pp. 291-301
16	#2. pp. 329-337	None	11,12,17	1,2,3,4,5				#2. pp. 156-162 #3. pp. 330-340 #7. pp. 422-440 #8. pp. 119-131 #9. pp. 299-305
17	#2. pp. 290-354	None	12,16,19		3			#2. pp. 137-244 #3. pp. 321-341 #4. pp. 293-356 #7. pp. 422-475 #8. pp. 119-131,174-178 #9. pp. 299-305
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